Remarks

Thorough examination by the Examiner is noted and appreciated.

The claims have been amended to clarify Applicants disclosed and claimed invention.

Support for the amendments is found in the original claims and the Specification.

No new matter has been added.

For example support for the amendments is found in the original claims and the Specification, for example at:

Paragraph 0022:

"The shield may have a ring-shaped configuration or a plate-shaped configuration and may be either electrically non-conductive or electrically-conductive. The electrically non-conductive shield alters the electric pathway between the anode and cathode in the electrolytic fluid. Consequently, the distribution of metal ions in the fluid, between the shield and wafer, **is changed in such a manner that the thickness of a metal layer deposited onto the wafer is substantially uniform across the edge and center regions of the wafer.**"

And Paragraph 0054:

"The electroplating deposition rate of metal onto the edge region of the wafer 42 **can be further controlled by adjusting the proximity of the shield 46 with respect to the wafer 42. Thus, when the switch 54 applies a negative charge to the cathode/shield 46, the electroplating deposition rate at the edge region of the wafer 42 can be decreased, as needed, by moving the shield 46 into closer proximity to the contact ring** 40. Conversely, when the switch 54 applies a positive charge to the anode/shield 46, the electroplating deposition rate at the edge region of the wafer 42 can be increased, as needed, by moving the shield 46 into closer proximity to the contact ring 40. Positional adjustment of the shield 46 in the electrolyte fluid 44 is accomplished by actuation of the positional adjustment motor 58 and positional adjustment arm 60."

And Paragraphs 0037 and 0038:

"In another embodiment of the apparatus, the shield is electrically-conductive and may be connected to a shield current source. A switch may be provided between the shield current source and the shield. When the switch is manipulated to apply a negative charge to the shield, the **shield acts as a cathode and reduces metal cations in the electrolytic fluid in the area adjacent to the edge region of the wafer.** This reduces the quantity of metal cations in the electrolytic fluid in the area adjacent to the edge region as compared to the area adjacent to the center region of the wafer. Consequently, the electroplating metal deposition rate at the edge region of the wafer is reduced to compensate for the normally lower metal deposition rate at the center region of the wafer. This
enhances the overall thickness uniformity of the electroplated metal across the entire surface of the wafer.

Upon application of a positive charge to the shield by manipulation of the switch, the shield acts as an anode. Accordingly, **the concentration of metal cations in the electrolytic fluid in the area adjacent to the edge**

region of the wafer is increased, to increase the electroplating deposition rate of the metal onto the edge region of the wafer, as needed. By the alternating application of positive and negative charges to the wafer by manipulation of the switch, the thickness of metal electroplated onto the edge region of the wafer can be precisely controlled to provide a layer of electroplated metal having a substantially uniform thickness across the entire surface of the wafer."

And Paragraphs 0046:

"As shown in Figures 3 and 4, the shield 46 typically includes a ring-shaped shield body 48 having a central shield opening 50. The shield body 48 may be an electrically-conductive metal or a non-conductive material such as plastic or ceramic, for example. **In the case of a non-conductive shield body 48, an electrically-conductive material 51 covers the surfaces of the shield body** 48. Preferably, the electrically-conductive material 51 is copper."

Support for new claims 25-29 are found in the Figures and at paragraph 0044:

The anode 36 and cathode 38 are connected to the current source 32 by means of suitable wiring 33. The bath container 34 holds an electrolytic fluid or electroplating bath solution 44. **The apparatus 30 may further include a mechanism (not shown) for rotating the wafer 42 in the electrolytic fluid 44 during the electroplating process, as is known by those skilled in the art.**

Claim Rejections under 35 USC 102(b)

1. Claims 1, 7-9, 12 and 19-21 stand rejected under 35 USC Section 102(b) as being anticipated by Ueno (US 6,391,168).

Ueno disclose a shield **which is fixed during a plating process** and has a **diameter smaller than a wafer and smaller than an anode** (see Abstract; Figure 2, Figure 4; col 3, lines 23-29). The shield (auxiliary anode electrode) **is supplied with a positive potential** to supply a greater electrical field to the center portion of the wafer (about half a diameter centered on the wafer) to compensate for the drop in potential that occurs from the wafer edge to the wafer center (relative to the anode) in order to achieve a uniform plating thickness (col 4, lines 35-65). Ueno also discloses a shield having a radius of curvature where the center portion of the shield is closer to the wafer at the center of the wafer in order to further increase the electrical filed strength at the center of the wafer relative to the periphery (See col 34, line 4 to col 6, line 6; Figures 6 and 7).

Thus, Ueno does not disclose several aspects of Applicants disclosed and claimed invention including:

"a shield provided between said cathode and said anode, wherein said shield is vertically adjustably moveable during an

electroplating process."

Thus, Ueno is clearly insufficient to anticipate Applicants disclosed and claimed invention.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Claim Rejections under 35 USC 103(a)

2. Claims 2-4 and 13-15 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Ueno, above.

Applicants reiterate the comments made above with respect to Ueno.

Ueno discloses either a flat plate shield about centered on a wafer and **having a diameter smaller than the anode** for increasing a field strength on the center portion of the wafer relative to the electric field strength between the anode and wafer periphery to compensate for a drop in the electric field between the edge and the center of the wafer (relative to the anode). Ueno also discloses a shield having a radius of curvature where the center portion of the shield is closer to the wafer at the center portion of the wafer in order to further increase the electrical field strength at the center of the wafer relative to the wafer periphery to compensate for the electric filed strength variation (See col 34, line 4 to col 6, line 6; Figures 6 and 7). Thus, employing a ring shaped shield or a plate shaped shield as disclosed and claimed by Applicants would not work in the method and apparatus of Ueno.

Ueno additional teaches that the shield is **non-reactive** with the electroplating solution (col 6, lines 18-21), and therefore cannot be a source of metal ions to be plated.

Nevertheless, as noted above, Ueno does not disclose Applicants invention and is therefore insufficient to make out a

prima facie case of obviousness.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)*.

3. Claims 6, 11, 18, and 23 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Ueno, above in view of Broadbent (US 6, 027,631).

Applicants reiterate the comments made above with respect to Ueno.

On the other hand, Broadbent disclose a method and apparatus where the shield is either fixed or rotated at a fixed position between the anode and cathode and where the **principle of operation is to modulate a time average of the electric filed between the anode and cathode by masking different portions of an electroplating surface during the electroplating process** to create

a desired plated thickness profile of the plated surface (see Abstract; col 2, lines 28-45; col 8, lines 19-44). Broadbent teach a rectangular, circular and edge curved shapes to accomplish **the modulating field effect** by rotating the shield relative to the plating surface so as to periodically mask portions of the plating surface and thereby modulate the electric filed between the cathode and anode surface to achieve a desired thickness profile of plated material (see Figure 3, Figure 5, Figure 7). Broadbent discloses an anode and cathode that are coaxially aligned (col 3, lines 30-36) although it is generally disclosed that other anode shapes and sizes may be used (col 4, lines 53-65). Broadbent also discloses and that the **shield is made of non-conductive material** in order to alter the electric field as taught (col 4, lines 61-64).

Thus, there appears no motivation for combining the teachings of Ueno and Braodbent, other than Applicants disclosure. For example, the apparatus and methods of Ueno and Braodbent work by a different principle of operation, i.e., a positive electric potential is applied to the fixed shield of Ueno to **increase a constant electric field at a center portion of a plated surface** to compensate for a decrease in electric filed strength between

the plated surface edge and a center portion, whereas in the method of Broadbent, no electric potential is applied to the shield of Broadbent, rather, the electric field is altered by rotating the shield relative to the cathode where the shield acts as a periodic electric field mask over portions of the plating surface to achieve a **time averaged** electric field. For example, using the non-conductive shield of Broadbent in the method of Ueno would make the method and apparatus of Ueno unsuitable for its intended operation.

Nevertheless, even assuming *arguendo*, a proper motivation for combination, such combination does not produce Applicants disclosed and claimed invention.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).*

"If the proposed modification or combination of the prior

art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious." *In re Ratti, 270 F.2d 810, 123, USPQ 349 (CCPA 1959).*

"If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." *In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).*

4. Claims 6, 11, 18, and 23 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Ueno, above in view of Cheng et al. (US 6,890,413).

Applicants reiterate the comments made above with respect to Ueno.

On the other hand, even assuming *arguendo*, a proper motivation for combining the teachings of Ueno and Cheng et al., the fact that Cheng et al. disclose a second cathode (negatively biased), **positionally fixed during an electroplating process,**

that includes a **wire mesh screening portion** for electroplating metallic features of different density on a surface of a substrate (see Abstract), does not further help Examiner in producing Applicants disclosed and claimed invention or making out a prima facie case of obviousness.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).*

Conclusion

The cited references, either individually or in combination, fail to produce Applicants disclosed and claimed invention including Applicants independent claims and therefore are insufficient to make out a *prima facie* case of obviousness.

Based on the foregoing, Applicants respectfully submit that

Applicants Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

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